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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/791,789	03/04/2004	Katsuyuki Morii	118396	5208

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EXAMINER	
CANTELMO, GREGG	
ART UNIT	**PAPER NUMBER**
1795	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/791,789	MORII, KATSUYUKI	
	Examiner	Art Unit	
	Gregg Cantelmo	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *09 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) *21-22* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 29, 2007 has been entered.

Response to Amendment

2. In response to the amendment received August 29, 2007:

a. Claims 1-22 are pending with claims 21-22 withdrawn from consideration as to a non-elected invention;

b. To date only the abstract of DE 19914680 has been considered in the absence of a full translation of this cited reference;

c. The claim objection is withdrawn in light of the amendment to claims 1 and 13;

d. The prior art rejections of record are withdrawn. However noting the change in scope of claims 1 and 13, Koschany is reapplied under 35 U.S.C. 102 since it is held to once again anticipate various claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-6, 8-11, 13-16 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,183,898 (Koschany).

Koschany discloses a method of forming a functional porous layer including a functional material (catalyst) that is supported on a porous material (gas diffusion layer). The method comprises: applying a plurality of solutions or dispersions containing the functional material (catalyst), the catalyst layer being applied in a plurality of steps at different concentrations onto the gas diffusion layer (see col. 5, ll. 41-68). By applying the catalyst material which is applied in a plurality of steps at different concentrations, each mixture application will have an inherent difference in surface tension and thus control the permeation of the catalyst material in the depth direction of the porous layer in accordance with the particular concentration of each distinct application step (as applied to claim 1).

Regarding the additional limitations of applying a supporter layer of either carbon or glass particles, the gas diffusion layer of Koschany comprises a carbon fiber nonwoven which is further coated with carbon particles (see example 1). Thereafter, the catalyst material layers are formed onto the carbon-coated carbon fiber nonwoven layer these carbon particles coated on the nonwoven prior to catalyst deposition are held to partially support the catalyst (functional material).

The layer is subsequently dried thereby removing the solvents (col. 5, ll. 35-41 as applied to claim 2).

By applying the various catalyst coatings having different concentrations, the content of the catalyst material varies in the depth direction of the gas diffusion layer (col. 5, ll. 25-35 and ll. 55-65 as applied to claim 3).

The solutions/dispersions are applied to the porous gas diffusion layer (GDL) containing the catalyst material to impregnate the solution/dispersion containing the catalyst material in the gas diffusion layer and this step is repeated for each solution/dispersion of a given concentration to provide a graded catalyst layer in the depth direction of the gas diffusion layer (as discussed above and as discussed in col. 5 of Koschany applied to claim 4).

Each solution has a different concentration of catalyst material (col. 5, ll. 55-65 as applied to claim 5).

The method of Koschany includes applying a first solution/dispersion containing catalyst material to the gas diffusion layer to impregnate the GDL with the first solution/dispersion and then applying at least a second solution/dispersion containing the catalyst material to impregnate the solution/dispersion in the GDL. The amount of catalyst material decreases with increasing distance from the surface of the support material (col. 5, ll. 55-65). Thus there is a higher concentration of catalyst at the surface of the GDL. In order to achieve this gradient, the concentration and surface tension of the second solution must be greater than that of the previous applied solutions in order to increase the amount of catalyst for each successive application as each additional application draws nearer to the surface of the GDL itself (as applied to claim 6).

The functional porous layer comprises carbon (see Examples and col. 2, ll. 35-55 as applied to claim 8).

The catalyst material includes various carbon-supported noble metals (col. 7, ll. 55-65 and Example 1 as applied to claims 9 and 10).

The catalyzed-GDLs described above are incorporated into the electrodes of a polymer electrolyte fuel cell wherein the fuel cell includes reaction layers and current collectors for each of the anode and cathode with each electrode reaction layer being those described above (see also col. 6, ll. 29-54). These electrodes are separated by an electrolyte membrane (see Examples as applied to claim 11).

Koschany discloses a method of forming a functional porous layer including a functional material (catalyst) that is supported on a porous material (gas diffusion layer). The method comprises: applying a plurality of solutions or dispersions containing the functional material (catalyst), the catalyst layer being applied in a plurality of steps at different concentrations onto the gas diffusion layer (see col. 5, ll. 41-68). By applying the catalyst material which is applied in a plurality of steps at different concentrations, each mixture application will have an inherent difference in surface tension and thus control the permeation of the catalyst material in the depth direction of the porous layer in accordance with the particular concentration of each distinct application step. The catalyzed-GDLs described above are incorporated into the electrodes of a polymer electrolyte fuel cell wherein the fuel cell includes reaction layers and current collectors for each of the anode and cathode with each electrode reaction layer being those described above (see also col. 6, ll. 29-54). These electrodes are separated by an

electrolyte membrane (see Examples as applied to claim 13). The layer is subsequently dried thereby removing the solvents (col. 5, ll. 35-41 as applied to claim 13). The porous layer comprises carbonaceous particles (see paragraph bridging columns 2 and 3 as applied to claim 13)

The reaction layers comprise a catalyst supported on the carbonaceous particles (See Example 1) and the content of the reaction layer material is varied in the depth direction of the GDL (col. 5, ll. 25-65 as applied to claim 14).

The solutions/dispersions are applied to the porous gas diffusion layer (GDL) containing the catalyst material to impregnate the solution/dispersion containing the catalyst material in the gas diffusion layer and this step is repeated for each solution/dispersion of a given concentration to provide a graded catalyst layer in the depth direction of the gas diffusion layer (as discussed above and as discussed in col. 5 of Koschany applied to claim 15).

The method of Koschany includes applying a first solution/dispersion containing catalyst material to the gas diffusion layer to impregnate the GDL with the first solution/dispersion and then applying at least a second solution/dispersion containing the catalyst material to impregnate the solution/dispersion in the GDL. The amount of catalyst material decreases with increasing distance from the surface of the support material (col. 5, ll. 55-65). Thus there is a higher concentration of catalyst at the surface of the GDL. In order to achieve this gradient, the concentration and surface tension of the second solution must be greater than that of the previous applied solutions in order to increase the amount of catalyst for each successive application as each additional

application draws nearer to the surface of the GDL itself (as applied to claims 16 and 20).

The porous layer comprises carbonaceous particles (see paragraph bridging columns 2 and 3) as applied to claim 1) which are applied to a current collector (col. 6, ll. 29-53 as applied to claim 18).

Response to Arguments

4. Applicant's have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments filed June 5, 2007 have been fully considered but they are not persuasive.

Applicant now argues that none of the prior art of record teaches of applying carbon or glass particles as a supporter layer.

The examiner disagrees.

Regarding the additional limitations of applying a supporter layer of either carbon or glass particles, the gas diffusion layer of Koschany comprises a carbon fiber nonwoven which is further coated with carbon particles (see example 1). Thereafter, the catalyst material layers are formed onto the carbon-coated carbon fiber nonwoven layer these carbon particles coated on the nonwoven prior to catalyst deposition are held to partially support the catalyst (functional material).

Thus Koschany is held to teach of applying a first layer of carbon particles onto the carbon fiber nonwoven and will at least partially support the catalyst material deposited thereafter.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 12 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koschany in view of either U.S. Patent No. 6,153,323 (Colbow) or U.S. Patent No. 6,753,108 (Hampden-Smith) and either U.S. Patent Application Publication No. 2003/0100824 (Warren) or U.S. Patent Application Publication No. 2003/0143444 (Liu).

The teachings of Koschany have been discussed above and are incorporated herein.

The difference between claims 12 and 19 and Koschany is that Koschany does not teach of forming the material with a discharger.

Various coating techniques for applying catalyst layers are known in the art including using ink-jet coating devices (i.e. a discharger). Such methods and systems

generally disclosed in Colbow (col. 5, ll. 45-50) or Hampden-Smith (paragraph bridging columns 39 and 40).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Koschany by depositing the catalyst material using a discharger such as an ink-jet coating device since such methods are known techniques for applying catalyst compositions to fuel cell electrodes and provide controlled amounts of a desired coating to a given substrate.

As to the particular types of dischargers being either a thermal discharger or piezo discharger:

First, as discussed above it is well known in the art to use ink-jet discharge devices to fabricate catalyst compositions in electrochemical cell devices as shown by each of Colbow and Hampden-Smith.

Second there is no apparent criticality for using a particular species of discharge device as evident from the disclosure of the specification. Notably, paragraph 69 on page 14 clearly teaches that any ink-jet type discharger can be used in the process of the instant invention and therefore absent criticality of the particular claimed ink-jet dischargers in comparison to all ink-jet dischargers, the selection of any ink-jet discharger would have been an obvious and equivalent alternative for depositing the catalyst layers.

Warren teaches that thermal dischargers are known for depositing materials onto a substrate (paragraph 323). Liu teaches of the preference to use thermal ink-jet dischargers to deposit catalyst materials in a fuel cell (paragraph 42).

Thus the concept of using any number of specific ink-jet dischargers would have been reasonably and readily apparent to one of ordinary skill in the art as a means for depositing catalyst fluids onto an electrode substrate. Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Koschany in view of the Colbow or Hampden-Smith by further selecting the ink-jet coating device to be any known species, including thermal and piezo ink-jet dischargers as taught by Warren or Liu since it would have provided a recognized depositing system and method for forming catalyst layers in a fuel cell device and since there is no apparent criticality for the use of the claimed particular ink-jet discharge device relative to the remaining known ink-jet discharge devices.

6. Claims 7 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koschany in view of Colbow or Hampden-Smith and either Warren or Liu as applied to claims 1 and 13 above and further in view of U.S. Patent No. 6,542,736 (Sompalli).

The difference between claims 7 and 17 and Koschany is that Koschany does not teach of forming the different solutions/dispersions using different solvents, however the full disclosure of Koschany is held to reasonably suggest such.

Koschany teaches of varying the amount of catalyst material in the GDL by applying successive catalyst coatings to the GDL wherein the different coatings have different catalyst concentrations. This results in a catalyst gradient formed in the GDL with the greatest catalyst concentration being disposed on the outer surface of the GDL which faces and is in direct contact with the electrolyte membrane (discussed above).

Koschany further recognized that the surface tension of the solutions/dispersions can be adjusted by incorporating additives or detergents into the solution (see col. 3. ll. 8-26).

Sompalli recognized that varying solvent concentrations and solvent materials impacts the degree which a solution will impregnate a porous GDL (see col. 9, ll. 15-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Koschany in view of Sompalli by varying the composition of the solvent for the various applied coatings and in particular to add detergents to the solvent for the first applied coatings to regulate the amount of impregnation for each applied catalyst coating and thus maintain the desired gradient catalyst coating to a given GDL.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Commonly owned U.S. Patent Application Publication No. 2004/0213902 (Ajiki) discloses a similar method for manufacturing a fuel cell but does not teach of the claimed surface tension limitations.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregg Cantelmo whose telephone number is 571-272-1283. The examiner can normally be reached on Monday to Thursday, 8:30-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gregg Cantelmo
Primary Examiner
Art Unit 1795

gc
November 8, 2007